INVENTIONS & INNOVATION

Success Story

ENERGY-SAVING RADIAL DEFLECTION PAD BEARING FOR ROTARY EQUIPMENT

New Bearings Increase Productivity and Improve Operating Energy Efficiencies for High-Performance Machinery

Benefits

- Reduces energy consumption by 5% to 10%
- Offers high load-carrying capacity
- Provides accurate shaft location
- Is stable at high speeds
- Has excellent start/stop capabilities
- Operates in high- and low-temperature environments
- Requires only low-viscosity lubricants
- Offers wide operating temperatures from superior heat dissipation

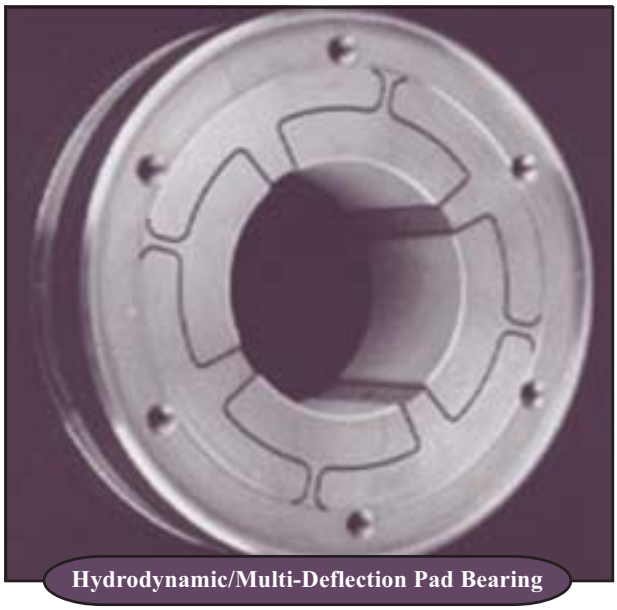
Applications

Bearings for rotational equipment, including automotive turbochargers, airplane engines, oil drilling equipment, and other machine parts that rotate at moderate to high speeds.

On the manufacturing floor, machinery can shut down and stop production when small parts such as bearings begin to wear down from the constant friction of machinery. Although bearings are produced to decrease friction, high-performance machinery such as turbochargers, oil drilling pumps, microturbines, and booster compressors require bearings that can operate at high speeds (135,000 rpm) and high temperatures (up to 160°F). Conventional bearings are not designed to operate under such conditions.

Russell Ide, a mechanical engineer with over 100 patents, developed a new bearing for high-performance machinery. With a grant from the U.S. Department of Energy's Inventions and Innovation Program, he developed a state-of-the-art fluid bearing called the Hydrodynamic/Multi-Deflection Pad Bearing. The new bearing is being manufactured and sold by KMC, Inc., and over 150,000 units have been sold to date.

With this new pad bearing, Ide increased the durability of the bearings and in the process improved operating energy efficiency between 5% and 10%. His initial technology also led to the development of spinoff technologies, customized bearing used in unique high-pressure machinery.



Hydrodynamic/Multi-Deflection Pad Bearing

Technology Description

The patented one-piece design of the new Hydrodynamic/Multi-Deflection Pad Bearing eliminates the multi-piece construction typical of standard tilt pad bearings. The new design significantly reduces the manufacturing tolerance and eliminates the pivot wear and contact stresses because friction is eliminated. The new pads form a hydrodynamic wedge shape at start-up that carries heavy loads on a thin fluid film. Inward pad movement during wedge formation virtually locks the shaft into position and provides good high-speed stability. Because pad deflection occurs instantaneously at start-up, the bearing may be used in frequent off/on, as well as continuous, operations. Since metal-to-metal contact is eliminated, wear and power consumption are extremely low. The bearings can withstand extremes of speed and temperature, allowing them to be run much harder. The pad design itself controls and allows for a minimum film thickness that allows for a longer run at optimal efficiency between planned maintenance. Since the pads are flexible, they eliminate the need for a perfect fit.

Energy Savings and Enhanced Performance

The Hydrodynamic/Multi-Deflection Pad Bearing has the potential to save from 5% and 10% of energy costs on all turbines across all industries, including utilities. Equipment run time to maintenance is two times longer than for conventional bearings, raising the power factor and output. The bearings allowed one high-performance machine, the Integrally-Geared Air Compressor, to reach 76,000 rpm – a speed never before attained. Load-carrying capacity has exceeded 4,000 psi but will vary depending on lubricant type and temperature.

Economic Success and Market Potential

The ability of this bearing to work at high speeds and under high pressure without having to engineer to exact fit specifications makes this an important breakthrough component in the revolutionary microturbine industry. It has a lifetime two to three times longer than conventional technology and tolerates lubricant contamination. In addition, this bearing maintains shaft location with more accuracy and can be used on a wide range of bearing-grade materials.

Inventions and Innovation Program

The Inventions and Innovation Program provides financial assistance for establishing technical performance and conducting early development of innovative ideas and inventions. Ideas that have a significant energy-savings impact and future commercial market potential are chosen for financial support through a competitive solicitation process. Inventions funded by the program have saved enough energy to light 10 million homes per year. In addition, the program offers technical guidance and commercialization support to successful applicants. Ideas that benefit the Industries of the Future, designated by the Office of Industrial Technologies as the most energy-intensive industries in the United States, are especially encouraged.

"This [DOE] grant was helpful to get things going. [I&I] provided credibility to the technology which helped with raising funds and getting sales."

– Russel Ide
Inventor

For project information, contact:

Dilip Jain
KMC, Inc.
20 Technology Way
West Greenwich, RI 02817
Phone: (401) 392-1900
Fax: (401) 397-6702
djain@kmcbearings.com

Home Page:
www.kmcbearings.com

For more information about the Inventions and Innovation Program, contact:

Lisa Barnett
Program Manager
Inventions and Innovation Program
U.S. Department of Energy
1000 Independence Avenue SW
Washington, D.C. 20585-0121
Phone: (202) 586-2212
Fax: (202) 586-7114
lisa.barnett@ee.doe.gov

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